

## CLAIMS

*What is claimed is:*

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1. A method of adjusting the power of a cable modem on a cable network, the method comprising:

(a) determining that cable modem signals received at or proximate a head-end of the cable network fluctuate in power by more than a defined amount;

10 (b) calculating a power adjustment using a plurality of recent power measurements of signals from the cable modem taken at or proximate the head-end of the cable network; and

(c) instructing the cable modem to adjust its power based upon the calculated power adjustment.

15 2. The method of claim 1, wherein a CMTS performs at least the determining and the calculating.

20 3. The method of claim 1, wherein the power measurements of signals from the cable modem are taken by an amplitude estimator in a CMTS.

25 4. The method of claim 1, wherein determining that signals from the cable modem fluctuate more than the defined amount comprises calculating a deviation from an expected power level over multiple recent power measurements of the cable modem's signals as received at or proximate the head-end of the cable network.

5. The method of claim 1, wherein the deviation is calculated over eight or sixteen of the recent power measurements.

30 6. The method of claim 1, wherein determining that signals from the cable modem fluctuate more than the defined amount comprises determining that the cable modem has been instructed to change its power level more than a threshold percentage of opportunities for adjustment.

35 7. The method of claim 1, wherein calculating the power adjustment comprises calculating an average difference between an actual power and an expected

power over at least eight recent power measurements at or proximate the head end of the cable network.

5 8. The method of claim 7, wherein calculating the power adjustment further comprises offsetting the average difference by a multiple of the deviation in actual power measurements over recent power measurements at or proximate the head-end of the cable network.

10 9. The method of claim 1, wherein calculating the power adjustment comprises determining an adjustment associated with a signal to noise ratio detected for upstream signals from the cable modem.

15 10. The method of claim 1, wherein instructing the cable modem to adjust its power comprises sending a ranging response DOCSIS message from a CMTS to the cable modem.

20 11. A method of controlling the power at which a cable modem sends data upstream on a cable network, wherein at or proximate a cable network head-end, the cable network periodically determines the power of upstream signals from the cable modem, the method comprising:

- 25 (a) adjusting the cable modem power based on a first technique;  
(b) determining that upstream signals from the cable modem contain more than a threshold level of noise or fluctuation; and  
(c) adjusting the cable modem power based upon a second technique that averages recent cable modem power measurements.

12. The method of claim 11, wherein adjusting the cable modem power based upon the first technique comprises:

- 30 (i) determining a difference between an actual power and an expected power of an upstream signal from the cable modem; and  
(ii) instructing the cable modem to adjust its power based upon the difference.

35 13. The method of claim 11, wherein adjusting the cable modem power based upon a second technique comprises:

- (i) calculating a power adjustment based upon a plurality of recent differences between actual power and expected power of upstream signals from the cable modem; and

(ii) instructing the cable modem to adjust its power based upon the calculated power adjustment.

14. The method of claim 11, wherein cable modem upstream power levels  
5 are determined using DOCSIS ranging requests.

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15. The method of claim 11, further comprising:  
determining that the upstream signals from the cable modem now  
contain less than the threshold level of noise; and  
10 returning to the first technique for adjusting the cable modem power.

16. A cable modem termination system comprising:

(a) a receiver arranged to detect received power levels from  
transmissions of a cable modem;

(b) means for calculating a single power level adjustment for the  
cable modem based upon a plurality of the detected power levels; and

(c) means for generating instructions to the cable modem to make  
the calculated power adjustment.

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17. The apparatus of claim 16, wherein the receiver determines differences  
between the detected power levels and an expected power level, wherein the means  
for calculating receives the differences from the receiver and calculates the single  
power level adjustment based upon the differences.

18. The apparatus of claim 16, wherein the receiver is a hardware device,  
and wherein the means for calculating and the means for generating are implemented  
as software.

19. The apparatus of claim 16, wherein the means for calculating  
calculates the power level adjustment by calculating an average based upon the  
plurality of detected power levels.

20. The apparatus of claim 19, wherein the means for calculating  
calculates the power level adjustment by offsetting the average by a multiple of a  
deviation in the detected power levels.

21. The apparatus of claim 16, wherein the means for calculating  
calculates the power level adjustment based on a signal-to-noise ratio determined  
from the plurality of detected power levels.

22. The apparatus of claim 16, wherein the means for generating generates a DOCSIS ranging response indicating the power level adjustment.

23. The apparatus of claim 16, further comprising means for determining whether signals from a cable modem contain more than a threshold level of noise.

24. A method of adjusting the frequency of a cable modem on a cable network, the method comprising:

(a) calculating a frequency adjustment using a plurality of recent frequency measurements of signals from the cable modem taken at or proximate the head-end for the cable network; and

(b) instructing the cable modem to adjust its frequency based on the calculated frequency adjustment.

25. The method of claim 24, wherein a cable modem termination system performs at least the detecting and the calculating.

26. The method of claim 24, wherein calculating the frequency adjustment comprises calculating an average difference between an actual frequency and an expected frequency over at least eight frequency measurements at or proximate the head-end of the cable network.

27. A computer program product comprising a machine readable medium on which are provided program instructions for adjusting the power of a cable modem on a cable network, the program instructions comprising instructions for:

(a) determining that cable modem signals received at or proximate a head-end of the cable network fluctuate in power by more than a defined amount;

(b) calculating a power adjustment using a plurality of recent power measurements of signals from the cable modem taken at or proximate the head-end of the cable network; and

(c) instructing the cable modem to adjust its power based upon the calculated power adjustment.

28. The computer program product of claim 27, wherein the instructions for determining that signals from the cable modem fluctuate more than the defined amount comprises instructions for calculating a deviation from an expected power level over multiple recent power measurements of the cable modem's signals as received at or proximate the head-end of the cable network.

29. The computer program product of claim 27, wherein the instructions for calculating the power adjustment comprises instructions for calculating an average difference between an actual power and an expected power over at least eight recent power measurements at or proximate the head-end of the cable network.

30. The computer program product of claim 29, wherein the instructions for calculating the power adjustment further comprises instructions for offsetting the average difference by a multiple of the deviation in actual power measurements over recent power measurements at or proximate the head-end of the cable network.

31. The computer program product of claim 27, wherein the instructions for calculating the power adjustment comprises instructions for determining an adjustment associated with a signal to noise ratio detected for upstream signals from the cable modem.

32. A computer program product comprising a machine readable medium on which are provided program instructions for controlling the power at which a cable modem sends data upstream on a cable network, wherein at or proximate a cable network head-end, the cable network periodically determines the power of upstream signals from the cable modem, the program instructions comprising instructions for:

- (a) adjusting the cable modem power based on a first technique;
- (b) determining that upstream signals from the cable modem contain more than a threshold level of noise or fluctuation; and
- (c) adjusting the cable modem power based upon a second technique that averages recent cable modem power measurements.

33. The computer program product of claim 32, wherein the instructions for adjusting the cable modem power based upon the first technique comprise instructions for:

- (i) determining a difference between an actual power and an expected power of an upstream signal from the cable modem; and
- (ii) instructing the cable modem to adjust its power based upon the difference.

34. The computer program product of claim 32, wherein the program instructions for adjusting the cable modem power based upon a second technique comprises instructions for:

(i) calculating a power adjustment based upon a plurality of recent differences between actual power and expected power of upstream signals from the cable modem; and

(ii) instructing the cable modem to adjust its power based upon the calculated power adjustment.

35. The computer program product of claim 32, further comprising program instructions for:

determining that the upstream signals from the cable modem now contain less than the threshold level of noise; and  
returning to the first technique for adjusting the cable modem power.